WASTE MANAGEMENT IN

NORTHERN TOWNS OF NAMIBIA

Muhammad Irfan Mughal

Bachelor's Thesis
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TAMPEREEN AMMATTIKORKEAKOULU
Tampere University of Applied Sciences

ABSTRACT

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Partnership for Local Democracy Development and Social Innovation (PLDDSI) is North-South cooperation program between Finland and Namibia. PLDDSI is cooperating with the Namibian towns in development of democracy, economic stability, environmental issues and waste management. Two students from Polytechnic of Namibia and one from Tampere University of Applied Sciences from Finland, were appointed by the PLDDSI to carry out a feasibility study on potential waste cooperation between three northern towns of Namibia, namely Ondangwa, Ongwediva and Oshakati. The study was conducted during the period of August and September in 2014.
A thorough analysis of current waste management situation was conducted. During the study following aspect were covered:

- Education of people about waste management
- People behaviour towards waste
- Waste collection
- Availability of waste management infrastructure
- Legal aspects
- Administrative structure
- Waste transportation
- Private contractors working in the towns
- Waste analysis
- Waste disposal

Different tools, like public surveys and audio-recorded interviews were used to collect information from the community and officials.
Based on the findings from this study and also from previous studies, recommendations are given to improve the potential cooperation on waste management and every aspect of the waste management in the three northern towns. One of the key problems is the lack of a proper landfill site or sites in these towns. Two alternative plans for building the landfill sites are given in the study. The landfill building proposals consist on the cost estimation, operational structure and building plan of the landfill site. Furthermore, a complete environmental and economically self-sustainable master plan of waste management is proposed. Some financial sources for constructing a proper landfill site and for waste management system are also researched and pointed out in this study.

Key words: Waste management, Cost estimation, Landfill site, Economic sustainability, Education

Foreword

Getting experience in the field of solid waste management was always a matter of privilege for me. Working in the most beautiful part of the world under the supervision of highly skilled and culturally enriched people has provided me a fabulous experience.

I would like to use this opportunity to thank PLDDSI and TAMK for aggrandizing my knowledge and skills. I would like to thank Mrs Eeva-Liisa Viskari and Mr Timo Palander for their support in my study and thesis.

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I am also deeply thankful to Mrs Hilma Kalumbu, Mrs Maria Phillemon, Polytechnic of Namibia, and all members of Northern Town Councils (Ondangwa, Ongwediva and Oshakati) for their support, cooperation and hospitality.

Tampere October 2014

Muhammad Irfan Mughal

CONTENTS

ABBREVIATIONS AND TERMS

CEO	Chief Executive Officer
DBN	Development Bank of Namibia
EIF	Environmental Investment Fund Namibia
GIZ	Gesellschaft Internationale Zusammernarbeit
MET	Ministry of Environment and Tourism
MRLGHRD	Ministry of Regional and Local Government Housing and Rural development
NRW	Non-Recyclable Waste
PET	Polyethylene Terephthalate
PLDDSI	Partnership for Local Democracy, Development And Social Innovation
PoN	Polytechnic of Namibia
RAD	Rent-a-Drum
RRR	Reduce, Reuse, Recycle
RW	Recyclable Waste
TAMK	Tampere University of Applied Sciences
The three northern towns	Ondangwa, Ongwediva and Oshakati
UNEP	United Nations Environmental Program

1 INTRODUCTION

This study was conducted in Namibia under the program known as Partnership for Local Democracy Development and Social Innovation (PLDDSI). The PLDDSI is a part of North-South cooperation program in Finland focussing on municipality level cooperation between Finland and Namibia. The program started in 2000, and from that time some 15 Finnish municipalities have joined it. The current PLDDSI partnership is operating to improve water and environmental management, economic development and improvement of democracy within the following municipalities and towns Ondangwa, Keetmanshoop, Kangasala and Lempäälä. Tampere University of Applied Sciences from Finland and Polytechnic of Namibia are also partners herein. The above-mentioned stakeholders in cooperation with local municipalities, towns and private companies have compiled many researches on waste management and recycling in Namibia. (Partnership for Local Democracy, Development and Social Innovation. 2014)

Namibia is situated in southern Africa, bordering with Angola, Zambia, Botswana, Zimbabwe and South Africa. It has a population of 2.1 million people and surface area of 824 292 km^2 making it 34^{th} largest country in the world. Due to extensive surface area, population density is very low, only 2,6 persons per square kilometre. Annual population growth is 1,4%. (Government of Namibia. 2014)

In November 2013, a workshop for three towns (Ondangwa, Ongwediva and Oshakati) was conducted to discuss about the waste management in the northern part of the country. In the workshop it was decided that a feasibility study on potential waste cooperation should be executed. The purpose of this study is to analyse the current environmental, economic and socio-economic status of the waste management in the three northern towns and to make proposals and suggestions for the potential cooperation within technical and institutional development of the waste management in the three town councils.

2 BACKGROUND

Based on previous studies and observation on waste management in the three towns the collection and maintenance of waste has become a burden and environmental health hazard to the community at large. The towns had tried to find different ways of disposing residential and domestic waste but still, this remains a major constraint. Some of the town councils have reacted to this issue in their development plans. For example, Ondangwa Structure Plan 2012-2042 indicates that an overall waste management plan should be compiled to ensure that the waste management process is dealt with in such a manner that waste does not become a significant risk to human health or the environment (Stupenrauch Planning Consultants. 2012).

2.1 The Northern Towns

According to the Namibia Statistics Agency (2012) and Around the World (2014), Ondangwa is a town of 22 822 people. During the daytime, however, there are more people in the town, since people from close-by areas travel to the town for shopping, working and business needs. Ongwediva is situated 27 km away from Ondangwa. This town is basically a residential town with population of 20 260 people. Oshakati is a fast developing town in the northern part of Namibia with a population of 36 541, making it the most densely populated of the three towns. Oshakati's town centre is seven kilometres away from Ongwediva, which makes it 34 km away from Ondangwa. However, these both towns are closely connected with infrastructure thus no clear border of the towns can be identified from the ground.

2.2 Previous Studies

There have been several studies on waste management since 1990s. Jones & Wagener compiled a research on of Waste Management Strategy for the Northern Town of Ongwediva in 1999. The aim of the research was to tackle the waste management problem in an integrated way. Jones and Wagener (1999) stated that the lack of appropriate by-laws on the waste management issue make it impossible to punish or fine of a persons

who are littering and dumping illegally. The aim of study was not only covering the collection and disposing of waste but also to find a safe environmental plan to minimize waste and to create awareness with the people in the area on waste management. Jones and Wagener pointed out some key issues in the waste management system and they also made some recommendation regarding by-laws. Despite the study having been compiled many years ago, only a little progress was occurred since then. A brief comparison of this study with today's situation reveals the key issues of waste management in these towns are still the same as they were two decades ago.

An environmental health and safety hazard study was carried out by students from Polytechnic of Namibia in a company called Rent-a-Drum. Their aim was to investigate on health hazards to the workers in and out of the material recovery facility in Windhoek. According to (Mazibuko & Zeriapi 2013), though the company has tried creating a safe environment for its workers, through providing safe working clothes, in general the factory will never be a safe environment. The students found problems such as the plant is not clean, waste scattered on the floor of the factory, dust mask for the workers are not replaced on regular so workers use them till they get new ones and workers who work in the glass section are not provided with ear plugs that can protect them from noise. Although there is room for improvements in the factory to make it less harmful, the nature of the business will not allow the working environment to be 100% safe since it's a business that deal with waste. Despite the publication of this study and common health hazard awareness, employees are still working on dumpsites without having enough protection.

Minna-Maarit Palander compiled study in 2013 concerning the average weight of waste in Molok Deep Collection systems in Onanjodkwe hospital, Oniipa and Ondagwa area. The first Molok containers were installed in these locations. Furthermore in 2013, a follow up study on monitoring of Moloks in coastal towns and northern Namibia was compiled. The purpose of this study was to examine the usage of the Molok system and to record the challenges that workers or users might have experienced during the installation. According to Alsins & Sundgren (2013), in Swakopmund the most of the Moloks were found with liquid at the bottom of the outer shell. The reason for this could be that large amount of bio-waste was being disposed in them. In Ondangwa and Oniipa, all the Molok containers were in good condition and were used frequently by locals. There were some smaller problems like most of this Moloks were located a bit far from users

and they were surrounded by vegetation making accessibility difficult. Alsins & Sundgren (2013) however concluded that the deep waste collection system was satisfactory and the users were generally pleased with it. Despite the successful results from the deep collection system, only a few towns have adapted the system.

3 CURRENT WASTE MANAGEMENT SITUATION

The current waste management situation is not satisfactory in Namibia. There is only one proper landfill site in the country that is situated in Windhoek and is managed by a private contractor. All towns and municipalities in the rest of the country are using dumpsites for waste disposal. Similarly, the northern towns are also lacking proper waste management systems. Towns are relying on private contractors that provide waste containers and collect recyclables and wastes from the waste containers. Only a limited quantity of the recyclables is being collected directly from sources, whereas the rest is going to dump sites along with other general waste.

3.1 Description of General Practice

The general practice in the three northern towns (Oshakati, Ongwediva and Ondangwa) is not in the line with international solid waste management standards neither with the national laws of waste management. Waste is being treated as waste and people are not always aware of the benefits related to the proper waste management. There is limited understanding of the harm that waste can cause to the environment, diseases caused to people and to animals and also the potential benefits, such as income that can be generated from recycled goods and the reuse or selling of the used products.

The concept of reduction, reuse and recycling (RRR) is very underdeveloped in these towns. Many people and businesses do not consider the environmental impact while performing their activities. For example, in markets and stores, customers get a lot of shopping bags along with goods, even with N$ 100 shopping 6-8 plastic bags are easily given, which is undesirable, since most of those bags cannot be re-used anywhere and are simply thrown away. It is considered as a part of customer care in Namibia to provide free shopping bags in abundance for the customers. Few use reusable (cloth or plastic) shopping bags, and the items that could easily be carried without plastic bags are also packed in plastic. A lot of refuse drink bottles and tins could be avoided by using fresh drink soda fountain machines but they are very scarcely to be found.

People generally dispose their waste all around, usually at the same place where they used them. The trash can be seen on roadsides, in front of the markets and parking places. There are no or very few waste containers along the roads, in front of markets and in public places. The places, which have waste containers, containers are broken or not enough for the need. There is only one waste container for all different type of waste such as metal waste, garden waste, domestic waste, electronic and paper etc. Only some places have separate waste containers, such as Rent-a-Drum cages, for collecting recyclables but even these are not being used effectively. Many times the waste containers are overfilled and there is trash all around the containers. When finally this trash is transported to dumpsites there are no systems for proper disposal of the refuse or material recovery.

This situation observed in Namibia represent our general behaviour towards waste management. Many developing and even some develop countries are facing the waste management problem around the globe. For the solution of any problem it is very important to realize the problem and seek solution. Namibian inhabitants and local municipality officials are quite vigilant in this case. Officials and inhabitants are fully aware of the problem and are trying there level best to find solution of the current waste problems.

3.2 Methods of Survey

Social behaviour and availability of infrastructure for the local waste systems were estimated by carrying out a survey in all three towns. The surveys were designed by the students to collect the data about the availability of infrastructure, condition of the waste containers, maintenance, waste collection, awareness about the waste management and people's views about the general waste management situation in the area. The surveys were written both in English and Oshiwambo (local language) for better representation and understanding of the participants. The questionnaire of the survey is attached as appendix on page number 68. Survey was distributed among random people, regardless of their age, or education. The survey was conducted on a printed-paper in the surrounding of town council office and open market in the town of Ondangwa, whereas in Ongwediva and Oshakati most of the participants were selected randomly near the super markets. Students and common people who came for shopping in the markets usually took part in the survey. Only 50 participants were included into the survey from each

town, which makes it 150 altogether. The number of the participants was kept low because of limited time available. The results have been discussed in the following chapters and overall results are shown in Table 3.1 and Figure 3.3.

3.2.1 Results of the Social Survey in Ondangwa

In Ondangwa, the social survey was conducted in the areas near the Ondangwa Town Council's premises and in the open market of Ondangwa, where usually people from the entire area and all type of people can be found. In the survey, young people and students were more cooperative and more willing to answer the questionnaire as compared to the old people. Some people were asking identification to prove that the survey is really being done for the Town Council and that the information will not be misused. This is because there are rumours that some organizations have run fake surveys and misused the information in the past. Anyway, an official motivation letter from the Town Council helped the students to prove their intentions.

The analysis of the survey showed that 44% of the participants had waste containers for waste disposal in their vicinity, whereas the rest of the participants did not have any access to the waste bins. However, the access was only a single waste container where all types of wastes, including, recyclables, bio waste, electronic waste and hazardous wastes etc. are dumped. Only 26% of the participants reported to have access to a deep waste collection system, shown in Figure 3.1, while others either had proper plastic container or the old fashioned metallic drum or similar shown in the Figure 3.2. Metal containers cannot be consider as a sustainable waste containers in a long run, as they get rusty and unusable very easily. Metal containers are usually without lid hence wind and animals can easily spread the waste out of them. Furthermore, metal containers attract thieves for scrap metal selling.

FIGURE 3.1. Deep waste collection system Molok Classic in Oniipa (Mughal. 2014)

FIGURE 3.2. Metal waste container in Oniipa (Mughal. 2014)

The survey's result showed that 50% of the participants reported that their waste containers have overflowed more than 20 days in a month. This shows that either the waste containers are very small to handle the amount of waste or the waste containers are not being emptied regular enough to avoid overflowing.

Social behaviour of the local people plays a major role in the waste management system of any country or area therefore several questions were included in the survey to find out common views and motivation towards solving the problem. In this survey, 58% of the participants responded that the waste management system is working well in their areas, whereas, 42% classified it as bad. 66% of the participants think that it is the Town Council alone who is responsible for solid waste management in their areas, whereas only 20% rightly believe that it should be a mutual cooperation between the local people and the Town Council. 46% of the participants have never visited the dumpsite in their local areas and many of those who have visited the dumpsite, seem to be happy with its current situation. To be exact, 40% of the dump site visitors said it is good or satisfactory. Only 32% of the participants have had some education about waste management whereas 68% of the participants have never had waste management guidance in their entire life.

3.2.2 Results of the Social Survey in Ongwediva

The same questionnaire was used for the social survey in Ongwediva as in Ondangwa. The survey is attached as appendix on page number 68.In Ongwediva the availability of infrastructure seems to be better than other two towns. In Ongwediva, 90% of the participants reported to have access to some kind of waste containers compared to 68% in Oshakati and 56% in Ondangwa. In Ongwediva, 42% of the participants have access to proper plastic waste containers for waste disposal. This is higher than 26% in Ondangwa but lower than 50% in Oshakati. 54% of the survey participants in Ongwediva have visited the dumpsite and 88% of the visitors were not happy at the current situation of the dumpsite, and that percentage is higher than the both other towns.

The Ongwediva inhabitants seem to have better responsibility behaviour towards waste management as compared to the other two towns. In Ongwediva, 62% of the partici-

pants believe that the waste management is the mutual responsibility of both the Town Council and local inhabitants.

Educational level about the waste management seems to be low in Ongwediva also, where 86% of the participants reported they have never had any sort of waste management education in their lives. Only 14% of the participants in Ongwediva confirm that they have been educated about waste management.

3.2.3 Results of the Social Survey in Oshakati

The same questionnaire was used in the Oshakati town as in other towns (Attached as appendix on page number 68. Oshakati is a bigger town as compared with Ondangwa and Ongwediva. In Oshakati, 68% of the participants reported that they have access to waste. In Oshakati, 50% of the survey participants have access to the proper plastic containers. 64% of the participants have visited the dumpsite area and 87% of the visitors thought that the dumpsite condition was bad or very bad. Oshakati is also little better in terms of social behaviour towards waste management as compared to others. 42% of the participants in Oshakati said that it is both locals and Town Council's responsibility to do the waste management as compared to Ondangwa, where only 20% of the participants thinks that its both locals and the town council that are responsible for waste management.

Education about the waste management in Oshakati seems to be of the same standard as in Ondangwa and Ongwediva, only 12% of the participants in Oshakati said that they have been educated about the waste management, whereas the rest of the participants had never been given any information about the waste management such as waste hazards, waste sorting, waste disposal or benefits of recycling etc.

TABLE 3.1. Comparison of the opinions on waste management by the citizens of Ondangwa, Ongwediva and Oshakati

Percentage of the survey participants	**Ondangwa**	**Ongwediva**	**Oshakati**
Have access to waste containers	56	90	68
Have noticed overfilled waste container (< 10 times/month)	32.5	67.5	50
Have visited dumpsite	46	54	64
Is not happy with the dumpsite condition	66	88	87.5
Think waste management is a responsibility of the community and the Town Council	20	62	42
Have got some waste management education	32	14	12
Is happy to overall waste management in the town	58	40	56

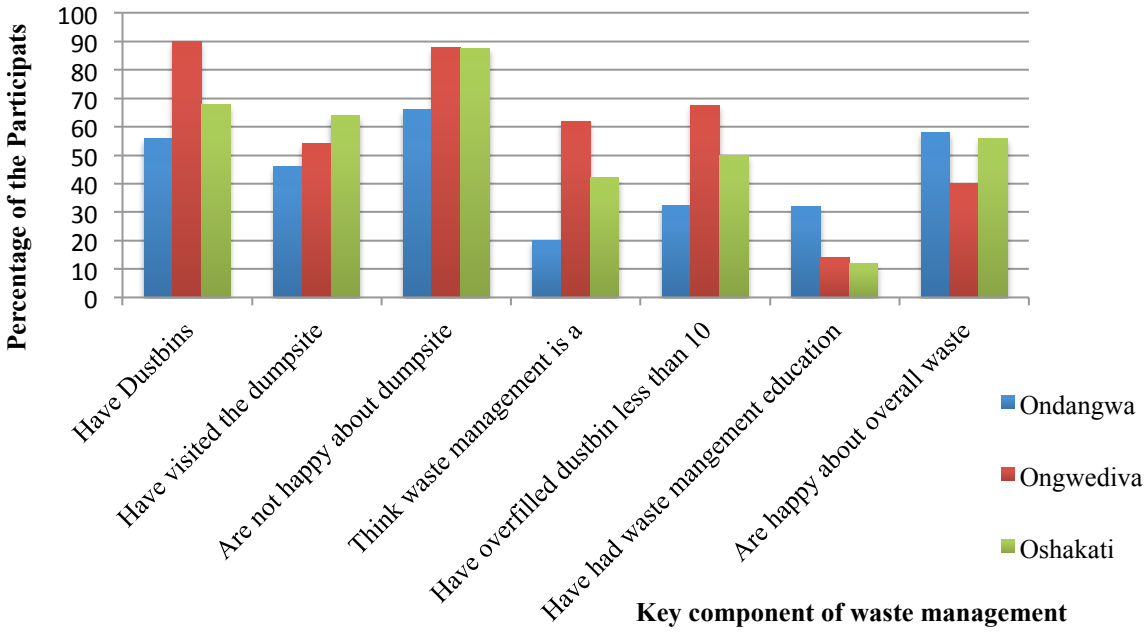

FIGURE 3.3. Comparison of the opinions on waste management by the citizens of Ondangwa, Ongwediva and Oshakati

Figure 5 shows that the waste management education is the least addressed section of waste management in all three towns and being the root of all problems. That is why the towns are all experiencing the waste management problems.

3.3 Waste Types and Estimation of Waste Volumes

Waste types mentioned in this section are identified by general observation of the dumpsite. The waste is categorized into two parts i.e. non-recyclable waste (NRW) and recyclable waste (RW). A list of the identified waste is provided in Table 3.2. It must be noted that NRW in this report means the waste, which are not being collected at the moment for recycling within the three northern towns.

TABLE 3.2. Recyclables and non-recyclable wastes identified in the three northern towns

Non collected wastes	Recyclable being collected in Northern municipalities
Building rubble	Plastics
Old tires	Polythene bags
Food trash	Glass
Leaves and wood	Paper
Sand	Card board
Ash	Pet bottles
Hospital waste	Tins
Animal carcasses	Metal pieces
Used oil	Parts of broken cars
Electronic waste	
Batteries	
Styrofoam	

It was a challenge to calculate the quantity or volume of the waste produced in these towns. This is because neither the town councils, nor the private contractors have proper records. Oshakati and Ongwediva calculate the number of trucks going to the dumpsite but the data is unfortunately neither reliable nor realistic. A study was compiled by Alsins et al. (2013) about the waste volumes and types in the northern towns but this data can also not be used as the focus of the study was to calculate the volume of recyclables and the study did not take into account the volume of building rubble, waste oil and hospital waste. Moreover, this data can also not be used in this study due the aim of this study is to calculate the total volume of all types of wastes instead recyclables only. Another way of calculating the waste per capita per month is to compare the data with some other city of the same country, which has more reliable waste production data.

Windhoek and Walvis Bay balance all their waste with a weighting bridge that is being brought to the landfill site. The amount of waste production per capita per month in Windhoek or Walvis Bay should not be very different from the northern towns as the culture and standard of living in both areas are not much different.

The waste production is therefore estimated by comparing the per capita waste production in Windhoek with the three northern towns. Windhoek produces 6 950 tons of general and hazardous waste per month (City of Windhoek. 2014). With the estimated current population of 326 000 (Namibia Statistics Agency. 2012), this means that the municipality is producing 21,3 kg of waste per capita per month. According to Alsins A. et al. (2013), Walvis Bay is producing about 1 204 tons of waste per month. When referred to Namibia Statistics Agency (2012), the population was approximately 62 000. With similar calculation as with Windhoek, the monthly amount of waste per capita would be 19,4 kg. By using, for example, a ratio of 20 kg per capita per month for the three northern towns, a total waste production can be estimated. The results have been indicated in Table 3.3.

TABLE 3.3. Estimated waste production of the three northern towns

	Ratio	**Population**	**Total (tons/capita/month)**
Ondangwa	20	23 000	460 000
Ongwediva	20	20 000	400 000
Oshakati	20	37 000	740 000
			1 600 000 (total)

Note: Populations have been rounded up to nearest 1000 (Namibia Statistics Agency. 2012)

3.4 Availability of Logistics

At the moment the Ondangwa Town Council has two trucks, two tractors and two bulldozers as well as one excavator. Nevertheless, the machinery is not always available for waste management as the other departments of the Town Council are also using it. The Environmental Department has outsourced most of the tasks to private contractors. Town itself has only seven workers working in the field of waste management including the officials. (Ndjodhi. 2014)

Similarly, Oshakati and Ongwediva also have outsourced most of the waste management tasks causing less need for logistic for waste management. The availability of waste management logistics in all three towns is shown in Table 3.4.

TABLE 3.4. Logistics available in the three northern towns

Name of the town	Trucks	Tractors	Excavators	Bulldozers	Compactors	Pick-ups
Ondangwa	2	2	1	2	-	-
Ongwediva	-	3	-	-	-	-
Oshakati	2	2	-	1	1	2

3.5 Private Contractors

In all three towns most of the waste management tasks are outsourced to private contractors. For example, cleaning of the town and waste collection is generally outsourced. Each town is usually divided into several areas and each area is then assigned to a particular private contractor for waste management. The town council usually publishes a tender for waste removal or cleaning in local newspapers and private contractors compete for that. The best private company is then awarded with a contract. When contractors are awarded waste removal and refuse tenders, both the town council and the private contractors enter into written agreements, which contain fixed terms and conditions.

3.5.1 Common Responsibilities of Private Contractors

According to Ondangwa Town Council's (2013) sample of a contract document with a private contractor, it demands the following features and activities from the appointed contractor.

1. The collection transport used must be suitable for the service area. It must be able to collect door-to-door waste from households, commercial business, government institutions and industrial areas.

2. In the event of a breakdown of the transport, it is the responsibility of the contractors to make back up vehicles and equipment to conduct their duties. The contractors are also responsible to keep the street and open area in his section clean. It is also the private contractors duty to provide their workers with personal safety equipment.
3. The contractors are required to collect all types of waste such as domestic waste, garden waste, dry industrial waste, bulk waste, tires and other polymeric products, medical waste, animal carcasses and also small quantities of hazardous wastes etc. Private contractors are required to provide sufficient services to its assigned areas every weekday and during public holidays. The normal operation time is 06:00–18:00.
4. For the town councils to monitor how the private contractors are doing their work a monthly meeting is conducted and it is the duty of the contractors to make sure that responsible persons represent the company at such meetings.
5. The contractors are required to keep detailed record of their activities. This may include the record of the volume of waste that the companies collect daily, accidents or incidents the contractors face during the operation, the complaints from people in the sections the contractors operate in etc.

3.5.2 Disposal

The town councils are responsible for informing the contractors on disposal methods, and place of disposal during the operation. This ensures that the methods area environmentally friendly and does not pose any threat to the public. In case of hazardous waste, local hospitals' incinerators may be used for disposal. Generally, all waste collected from the towns is transferred in the dumpsites.

3.5.3 Penalties

In the event were contractors fail to properly perform their operations within their service areas during the contract periods, the contractors will face fines. Firstly, the contractors are given warnings before penalties are applied. The fines mostly depend on the type of mistake or level of negligence the contractors have committed. According to

Ondangwa Town Council (2013) sample contract, a council representative is entitled to apply the penalty or penalties depending on the type of an offence the contractor did.

3.5.4 Number of Private Contractors

There are five private contractors working for the Ondangwa Town Council. Four of them, namely Tshila Trading Enterprises cc, Ketu Keya Investment cc, Lika Investment cc and Alugodhi Construction & Renovation cc, have the responsibility of collecting, transporting and recycling of wastes. Each of them has several trucks that collect door-to-door waste in the assigned areas of the town. They usually hire local people who work manually to collect the recyclables from the waste.

The 5th contractor is Rent-a-Drum. RAD is actually a waste management company and has worked in Namibia for several years. The company works as a waste collection, transport and recycling company but they also have provided the deep waste collection systems known as Molok in many towns and municipalities in Namibia including Ondangwa. Besides that RAD has also been partner in several studies with PoN and TAMK for the improvement of waste management system in Namibia.

Oshakati is bigger town as compared to Ondangwa and Ongwediva, and they have hired altogether 14 private contractors for performing waste management function in their town. Ongwediva has four private contractors to do the cleaning and refuse removal job in their town. For certain unknown reason the information and contacts of the private contractors, was not provided from the Ongwediva Town Council.

3.5.5 Expenses Generated by the Private Contractors

After analysing the waste management budget of Ondangwa and Oshakati Town Councils, it is clear that one of the biggest parts of the waste management budget in both towns is allocated and provided to the private contractors. Figure 3.4 shows the amount paid to all contractors as a whole during the past few years in Ondangwa and Oshakati. Private contractors also have the right to sell the recyclables collected during their operational activities.

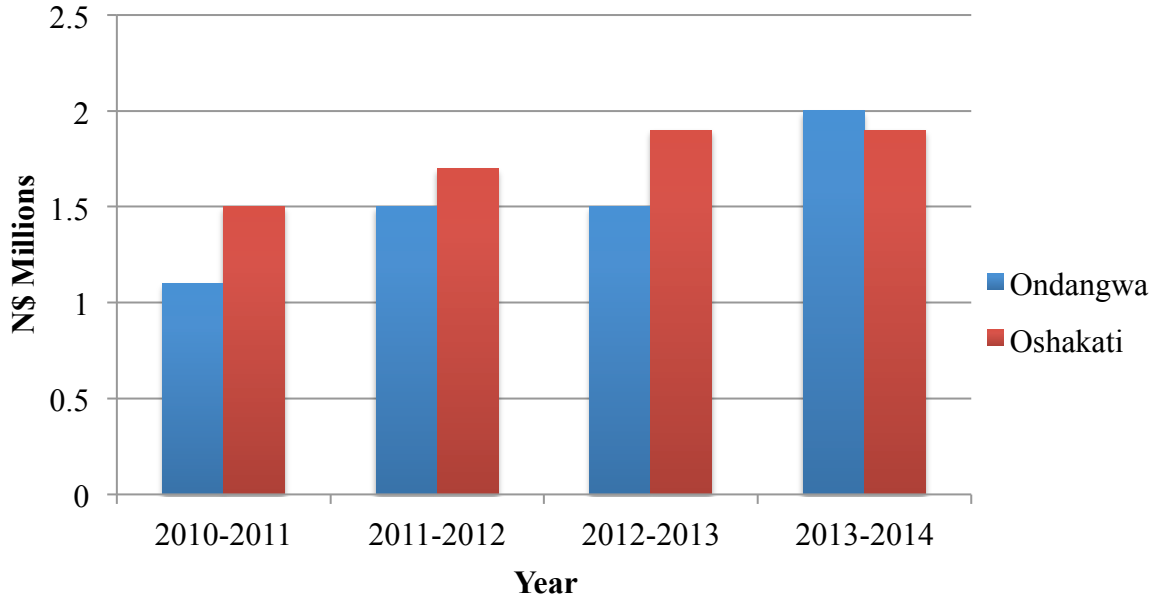

FIGURE 3.4. Expenses generated toward the town councils by the private contractors of their services

Although, private contractors are doing a fair job on collection and transportation of the waste but several factors is still prevailing which not yet being performed on acceptable level. Roads and streets are still dirty although it is the responsibility of private contractors to clean them. Town councils also experience difficulties in fulfilling their responsibility of checking and controlling the private contractors. Neither the town councils nor any of the private contractors have reasonable data about the volume of waste being produced and collected in the towns.

It is clearly stated in the contract agreement that if private contractors fail to perform their duties a fine can be imposed after an initial warning. It has not been practiced in the towns although private contractors have somehow failed to perform their duties, like cleaning the roadsides, record keeping and managing the dumpsites. Only Oshakati Town Council has imposed a penalty on one of the private contractors, but so far only once.

3.6 Conditions of the Dumpsites

3.6.1 Ondangwa Dumpsite

The Ondangwa dumpsite is almost 3,0 km away from the town council's premises. The boundary of the dumpsite is irregular but the approximate area is four hectares (Google. 2014). The location of the dumpsite is not far from the residential areas. All types of refuse like metals, plastic, shopping bags, bio wastes, garden refuse, electronic waste, hospital waste, hazardous waste and building rubble etc. are dumped at the same place. There is a fence around the dumpsite, which is in need of some repairs. It is not strong enough to keep the animals away from the dumpsite as there are sheep and goats wandering all over the dumpsite in search of food as it is shown in Figure 3.5.

FIGURE 3.5. Animals wandering around in Ondangwa dumpsite (Mughal. 2014)

Currently there is no-record keeper or checker for the dumpsite control. Numerous trucks of waste are unloaded into the dumpsite every day without a record. Anybody can dump anything in the dumpsite without paying any fee or providing any information. There are people working, as shown in Figure 3.6, on the dumpsite, usually old ladies, who collect the recyclables from the waste. They are provided with masks and gloves to avoid contamination from waste. The protective measures and clothing pro-

vided to the workers at dumpsite is inadequate and will have to be addressed. After the workers have collected all the recyclables as seen in the Figure 3.7, the rest of the waste is burnt on daily basis to reduce the volume of the waste. The smoke is spreading all over the area. This aspect also needs to be addressed.

FIGURE 3.6. Workers collecting recyclables from Ondangwa dumpsite (Mughal. 2014)

FIGURE 3.7. Recyclables collected from Ondangwa dumpsite (Mughal. 2014)

3.6.2 Dumpsite Condition in Ongwediva and Oshakati

The condition of the Ongwediva and Oshakati dumpsites is not much different from that in Ondangwa. The only difference is that Oshakati and Ongwediva have better fences around the dumpsites. This fence also helps to prevent the garbage from spreading around during windy conditions. There are animals and cattle in both dumpsites like in the Ondangwa dumpsite and in both sites people are collecting the recyclables. Both towns of Oshakati and Ongwediva allow all types of waste to be dumped, and the refuse is burnt to decrease the volume of the waste. The following photos show that there are no remarkable differences between the three dumpsites (Figures 3.8, 3.9 and 3.10). The only difference to Ondangwa dumpsite is that Oshakati and Ongwediva keep a basic record of waste in terms of trucks that are being dumped in their dumpsites and they also have bulldozers to level the surface.

FIGURE 3.8. Ongwediva dumpsite (Mughal. 2014)

FIGURE 3.9. Oshakati dumpsite (Mughal. 2014)

FIGURE 3.10. Electronic waste in Oshakati dumpsite (Mughal. 2014)

3.7 Legal Situation

The Namibian legislation related to the solid waste management was updated in 2007. The Environmental Act of 2007 is currently the applicable legislation for waste management in the country. The National Waste Management Act provides the guidelines for different waste related issues, but it does not elaborate on the details. For example, there are clauses about the protection of the environment and the natural resources, and statements that the activities, which harm the environment, should be, reduced and controlled. (Government Gazette of the Republic of Namibia. 2007) The law does however not really explain the plan of action in detail like how the execution of certain function should be done.

Especially in the field of waste management there are only directions for overall operations in the country with no further details. For example, the Environmental Management Act no.7 of 2007, Article 4 states that:
"*A person may not discard waste or dispose of it in any manner, except: At a disposal site declared or approved by the Minister in terms of this section". The National law forbids people from throwing waste anywhere, but only at places which are declared as waste disposal sites.*" (Government Gazette of the Republic of Namibia. 2007) Similarly, there are penalties mentioned in the law for non-compliers i.e. Section (4)(b) of Act no .7 of 2007 states that waste should only be disposed in the manner or by means of a facility or method and subject to such conditions as the Minister prescribed. Section (5) of Act .7 of 2007 indicates that any person who contravenes subsection (4) of this act commits an offence and is liable to the fine not exceeding N$ 500 000 or imprisonment for a period not exceeding 25 years. (Government Gazette of the Republic of Namibia. 2007)

It can be seen from the above example that although law prohibits the illegal waste dumping, it does not give any criteria for the selection of proper dumping sites except that it has to be prescribed by the ministry but then there are no guidelines for the ministries on what criteria should be taken into account before declaring a site as dump site.
Although there are fines and penalties mentioned in the law, there are no guidelines for which the responsible persons are to impose this on the non-compliers. There are also no guidelines for waste reduction, waste collection, waste transport, and recycling and also nothing for the proper removal of the refuse.

Because of the above-mentioned problem, the towns are allowed to have their own by-laws regarding waste management subject to approval of those by-laws by the regional authorities. Oshakati and Ongwediva have compiled simple lists of the transgressions and fine amounts. The by-laws or the regulations currently being used by the towns are very limited and do not cover the complete aspect of waste management. There are actually no detailed regulations to define different types of the offences in term of waste management. There is no law that restricts the visitors, animals and workers at the dumpsite to avoid the spreading of health hazards. There is also no regulation against the burning of waste, neither are there any regulations about the management of landfill/dumpsites.

4 ECONOMIC SITUATION

In this section the economic condition of the three town councils is analysed for waste management. The aim of the budget analysis is to find out the amount of funds available in all three towns for waste management, thus the future planning of the waste management systems could be done based on the amount of funds available.

4.1.1 Waste Management Budget in Ondangwa

The Ondangwa Town Council's waste management budget data was supplied by the Finance Department upon request. The data covers the years from 2010 until 2014. The budget for waste management falls under the Environmental Health Department and it is named as "Cleaning services". The budget is formulated annual basis, financial starting in July and ending next year in June.
The budget is subdivided into several fields like:

- Salaries and wages of the staff and workers
- Transportation
- Medical allowances
- Overtime charges
- Material purchases
- Fuel charges
- Pensions
- Protective clothing
- Cleaning
- Machine and vehicle purchasing etc.

The distribution of the budget into different sub-votes is quite comprehensive and it shows that the money has been distributed into different waste management fields in a proper way. Analysis of the budget data reveals that the annual waste management budget has been constantly increased since 2010 until 2013, which confirms the town's concern and commitment towards the waste management function. In financial year of 2010/11 a sum of N$ 2,19 million, in 2011/2012, N$ 2,93 million, in 2012/2013, N$ 6,58 million, were allocated for waste management in the town but in 2013/14 the waste

management budget is lower than in the previous year. Only N$ 3,54 million was allocated for waste management for year 2013/2014. The reason for the lowering in the budget is that increased revenue generated from refuses collections had been offset against budget. The analysis of the budget reveals that the waste management allocated budget was not fully used in any of the previous years. The sum of N$ 2,08 million was used out of a budget of N$ 2,9 million, so an amount of N$ 0,85 million, which is 20% of the full waste management budget, remained unused in the waste management department. In this way some equipment remained un-purchased. For example, N$ 325 000 was allocated for buying waste containers but only N$ 62 408 was used for this purpose. Similarly N$ 345 000 was allocated for machines and equipment purchases in the budget of 2010/11, but only N $3 0301 was used.

Similar situations were found in the budgets of 2011/12 and 2012/13, where 29% and 48.8% of the allocated budgets respectively remained un-used. The current year's budget (2013/2014) is just out in the beginning of July and is cut down to half as compared to the previous years. One reason for reduction in the waste management budget for this year could be due to the fact that considerable amounts of waste management have remained unused in the previous years.

On the other hand the social survey suggests that there is a strong need for waste management infrastructure as 44% of the survey participants reported that they do not have access to the waste containers and those who have access to the waste container are using only one waste container for all types of wastes. Shortage of tractors, bulldozers and other machinery was also identified in the area. Figure 4.1 shows the different amounts of the budget allocated and used in the Ondangwa Town Council from 2010 to 2014. Figure 4.1 shows the budget allocated spent and available funds in each year.

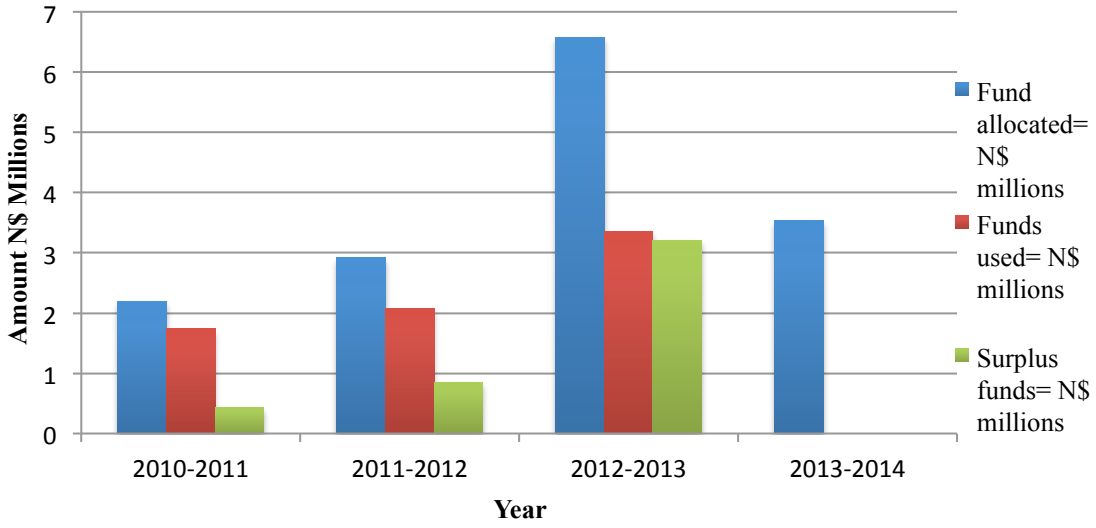

FIGURE 4.1. Ondangwa waste management budget analysis

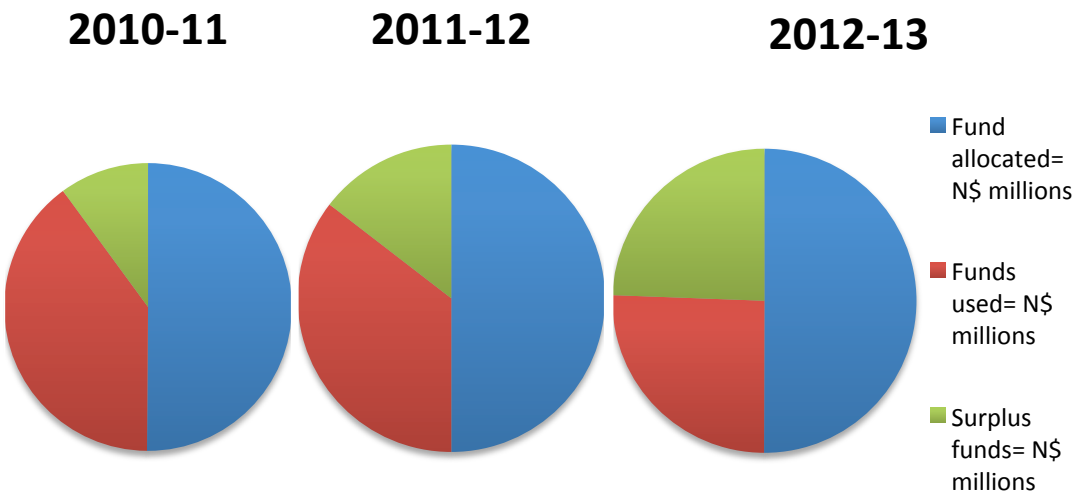

FIGURE 4.2. Waste management annual budget allocation and expenditure in Ondangwa.

4.1.2 Waste Management Budget Analysis Oshakati

Oshakati Town Council's waste management budget is shown in the Table 4.1. Oshakati is bigger town when compared to Ondangwa and Ongwediva but their waste management budget is not as high as theirs. One reason for that could be that they have N$ 3,0 to N$ 4,0 million annual waste management income, offset against the budget.

Charging the residents and business for waste collection generates some income from waste management.

TABLE 3. Annual waste management budget (million N$ m) in the town of Oshakati

Year	Allocated Budget	Expenditure	Surplus funds
2009-2010	3.6	3	0.6
2010-2011	5	3.8	1.2
2011-2012	4.3	3.6	0.6
2012-2013	4.4	3.7	0.7
2013-2014	4.2	3.8	0.3

Although Oshakati Town Council does not have very large budget, they have, unlike Ondangwa Towns Council, utilized a substantial part of their annual budget each year and only a fraction of the allocated money was left unused. Figure 4.3 shows Oshakati Town Council's budget and expenditure.

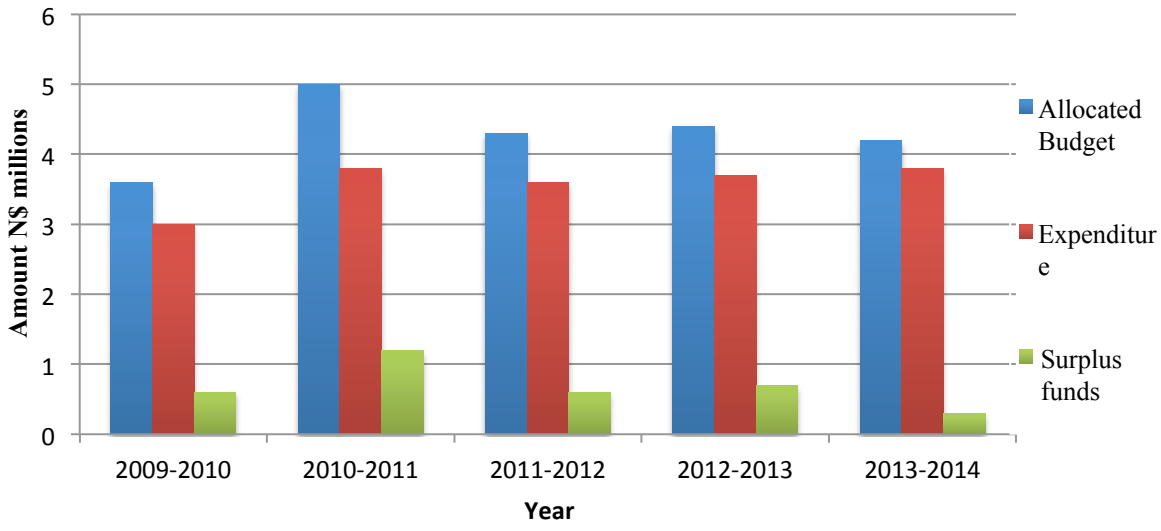

FIGURE 4.3. Waste management budget of Oshakati Town Council (Mughal. 2014)

4.2 Administration

4.2.1 Administration at National Level

In Namibia, many ministries have some obligations towards waste management. Generally there are eight ministries that have some kind of responsibility to manage waste, but only two out of these ministries deal with this issue at large. These two ministries are Ministry of Environment and Tourism and Ministry of Regional and Local Government, Housing and Rural Development. These two ministries are then divided and subdivided at different levels. An overview of the organizational structure is shown in the Figure 4.4.

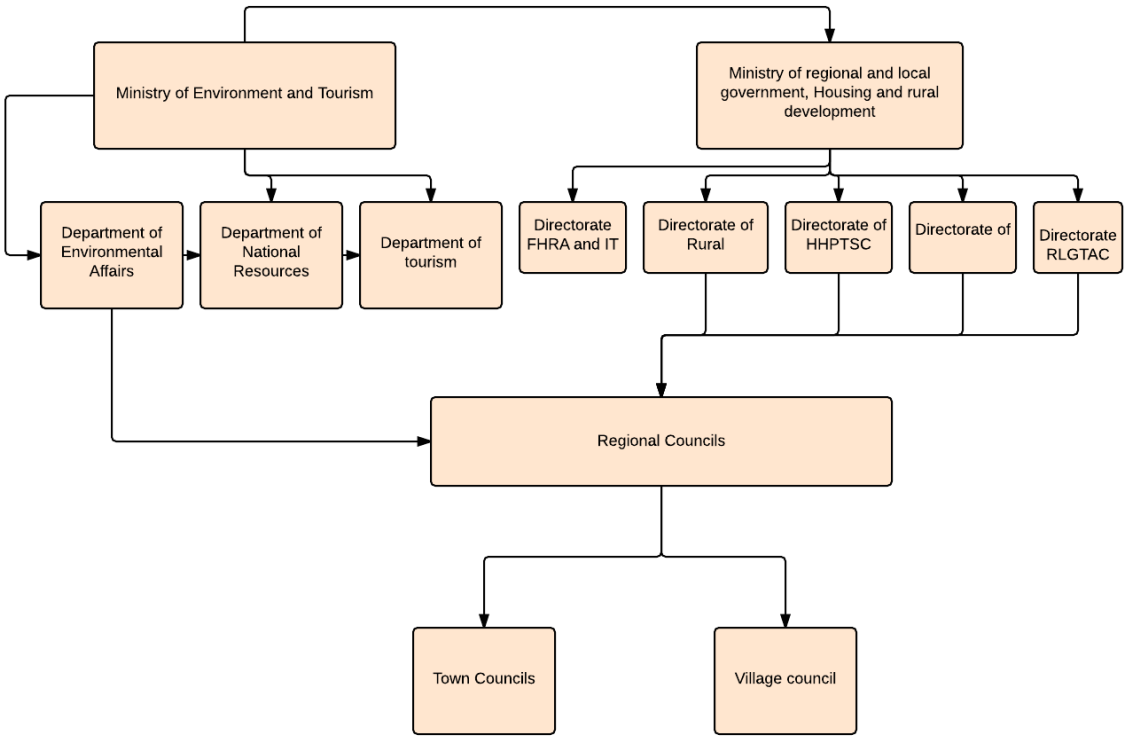

FIGURE 4.4. Organizational structures of Ministry of Environment and Tourism and Ministry of Regional and Local Government, Housing and Rural Development (Ministry of Environment and Tourism. 2014; Ministry of Regional and Local Government, Housing and Rural Development. 2014)

Ministry of Environment and Tourism

The objective of this ministry is to promote biodiversity conservation in Namibia, through utilization of natural resources and tourism development for the maximum social and economic benefits of its citizens. With the help of other ministries in the country this ministry aims to create safe environments for its wildlife together with its communities, through conservation, management and control of the available resources. Under this ministry there are three departments, namely: Department of Environmental Affairs, Department of Natural Resources, Parks and Regional Services and the Department of Tourism, Planning and Administration. (Ministry of Environment and Tourism. 2014)

In the Department of Environmental Affairs, there is a Division of Environmental Assessment, Waste Management, Pollution Control and Inspection. This division is there to assist the ministry by implementing legislation for protecting and controlling environmental pollution and waste management. The Board also helps with conducting various assessments and research on environmental issues that the people in the country face and helps with waste management's in the country. The Division also provides the ministry with the provision and guidance of creation of environmental and waste management act of the country. (Ministry of Environment and Tourism. 2014)

Ministry of Regional and Local Government, Housing and Rural Development

The main objective of this ministry is to create fairness to its communities through economic assistance, rural development, housing provision and facilitating effective local government. Under this ministry there are five Directorates that help the ministry in its operation: Directorate for Housing Habitat Planning and Technical Services, Directorate for Rural Development Coordination, Directorate for Decentralization, Directorate for FHRA & IT and the Directorate of Regional and Local Government, Traditional Authority Coordination. The duties of "Directorate for Decentralization" are to make sure that there is good coordination and management among the bodies of this ministry (regional, local and traditional authorities). The other four Directorates help the ministry facilitate and establish effective development for communities throughout the country. It also helps to bring the government close to the people so it can deliver its required serves for community satisfaction. (Ministry of Regional and Local Government, Housing and Rural Development. 2014)

Under these two ministries the regional and local authorities are found, were the three northern towns manage their waste respectively. These local towns are under the direct supervision of these two ministries when dealing with waste management.

4.2.2 Organizational Structure at Town Council Level

The three northern towns do not have proper waste management departments. Waste management activities are under departments of environment and public health or such in all studied towns.

The Public Health and Environmental Management

The duties of this department are to make sure that the residents and environment are safe. It is also the duty of the department to keep the public informed about the health and environmental risks. The department usually consists of Senior Environmental Officer, Environmental Health Practitioner and Cleansing Officer.

Senior Environmental Officer (supervisor)

The responsibility of senior environmental officer is to find out and implement effective waste and environmental management activities. Other responsibilities include doing environmental scanning of the town on continuous basis and find out areas that require regulations to prevent health and cleanliness related problems. He/she also deals with the identification of remedial action, steps and amendments in the existing environmental policies and regulations.

Environmental Health Practitioner

The responsibility is to develop and implement effective waste and environmental management mechanisms and measures to ensure compliance with all relevant health and environment standards and regulations.

The Cleansing officer

The main duties for the cleansing officer are for sanitation, general cleansing of the town and residential area inspection.

At the town level, the waste management organisation may be improved. The responsibilities and duties should more clearly be defined within the organization.

Currently it is difficult to get any information or even public data from the town. Operations seem to be cumbersome and require many formalities. The concept of data collection and maintainence is not very clear. Staff and officials are scarce and in some cases they lack the necessary skills and knowledge.

5 GENERAL RECOMMENDATIONS

5.1 Social Behaviour Improvement

The survey showed that the public in all three northern towns, namely Ondangwa, Ongwediva and Oshakati, do not have proper education and information about waste management. There is a strong need to educate the public about waste management. The information should be spread by educating to the school children, by launching cleaning and environmental health campaigns and also by advertising in the print and electronic media. People should be educated about the pros and cons of waste management and also steps should be taken to make sure that the public realize that it is not only the town councils' responsibly to protect the environment, but that it is in-fact the mutual responsibility of communities and towns to play their role in waste management and environmental protection. The towns should provide waste containers at all public places and should put signboards to guide the public about waste management.

5.2 Legislative Improvement

The current national law is not efficiently covering all aspects of the waste management, therefore there is a strong need for developing by-laws and regulations with more details. Legislation regarding waste management should be clear and easy to understand for all. Damage to the waste management infrastructure like damage or stealing of waste containers or landfill/dumpsite's fencing should be a punishable crime by law. The law should define different levels of punishment for different degrees of offenses. The regulations should also define the way of enforcement of the law and execution of the punishment.

Legislation should also be established and implemented for the punishment of administrative negligence in waste management. People should be awarded right by law to sue the Councils and Administrations for negligence or transgressions regarding the waste management. The law should clearly define the circumstances under which transgressors should receive spot fines and should also define the situations where the transgressors should be taken to the court for prosecution depending on the degree of the offense. Normally small offenses should be spot fined whereas; bigger non-compliers should be

charges in court. Processes should be developed for the proper enforcement of the waste management laws.

Nobody should be allowed to work with the waste without proper protection and permission from the town council. All workers working at the dumpsites at the moment should immediately stopped from working, because they are dealing with mixed waste which poses serious threats to their health. The current personal safety equipment is not adequate enough to protect the workers from the health hazards. Law should define the level of personal safety equipment. It should be necessary by law to conduct a health assessment survey periodically, on all workers working with the waste. Laws should also be developed for the regulation of private contractors dealing with waste management. There is a strong need to make laws for the health protection of all the workers working in the waste management system. Any company or contractor who fails to protect the health of his/her workers should be suspended and punished according to the degree of negligence.

5.3 Administrative Improvement

Although most of the waste management tasks are outsourced, there is still a need for efficient and separate waste management departments in the towns. The staff and officials should be skilled and knowledgeable. There should be some annual training program for the updating the waste management knowledge and skills in the towns. Jobs and duties should be clearly defined and there should be responsible persons for each task. Bureaucratic process should be clear and short for accessing information or funds. Record keeping should be necessary and there should be a clear and easy complaint and feedback system for the public.

6 LANDFILL PLANS

6.1 Common Landfill Site for All Three Northern Towns

All three towns Ondangwa, Ongwediva and Oshakati are near to each other. The distance between Oshakati and Ongwediva is seven kilometres, whereas the distance between Ondangwa and Ongwediva is 27 km. (Around the World 360. 2014). According to Namibia Statistics Agency (2012), the overall population of all three towns was 79 623 in 2011. This figure is estimated to have risen approximately to 89 000 in 2014 due to high population growth and migration of people from villages to towns. Since these towns are in close vicinity to each other, it is highly recommended to build a common landfill site for all three towns, as it will be more environmentally sustainable and more economically feasible. In such case the cost and expertise can be shared among the three towns.

A comparison between the three northern towns and Windhoek municipality is made to assess the area, waste production and cost for the landfill. The population of Windhoek municipality was 325 858 in 2011, which might have reached 354 000 in 2014 (Namibia Statistics Agency. 2012). The comparison of Windhoek and the three northern towns' overall population shows that the northern towns have 25% of Windhoek's population, so theoretically the amount of waste production in the northern towns should also be 25% of Windhoek's waste production since the per capita volume of the waste should be similar under similar standards of living.

Based on that theory, the three northern towns require not even half of the size of the landfill, which Windhoek has at the moment. Windhoek has six waste cells in the Kupferberg landfill site, four for general waste and two for hazardous waste. The total size of the cells is approximately 30 000 m^3. That means the three northern towns will require two cells, one cell for general waste and one cell for hazardous waste for proper waste management.

6.1.1 Area Required and Possible Site of Construction

The Windhoek municipality has around 30 hectares of landfill area and it is estimated to be adequate for at least 30 years (Hewicke. 2014; Google. 2014). If the three northern towns produce 25% of the amount of waste that Windhoek produces then the area requirement should be also 25% of 30 hectares, which is 7,5 hectares. Nevertheless, for future growth and possible forthcoming new stakeholders such as Oshikango, Outapi, Omuthiya etc., the area should be considered as double, meaning 15 hectares. The three northern towns need to build only two cells of landfill instead of six, but they will also need space to build up office building, garage for machinery, wastewater pond, parking area, weighing bridge, dumbing areas for building rubble and garden waste as well as basic services such as roads, electricity and water distribution. By taking all that into account it is highly recommend to start with an area of ten hectares. Five more hectares should be added to the landfill area in next 10-15 years thus more cells could be developed as the waste load grows with the growing population and industry. An area of ten hectares should be enough for 30 years but a more precise survey should be conducted.

The site selection should be done very carefully; neither should it be very far from the towns nor very near to any settlements. It is recommended that the landfill site should be minimum one kilometre away from the boundaries of all settlements. The ideal place for the common landfill site could be somewhere in the middle of Ondangwa and Oshakati, so that all three towns would have logistically viable and cost-effective access to the landfill site. A geological survey should be done and a proper environmental impact assessment study should be executed beforehand to ensure that the proposed site is not in the flood stricken area and it will not have negative long lasting effect on the environment.

6.1.2 Building Process

The building process of the landfill site will follow the basic rules of construction project management. First of all, a certified professional engineering company will be hired for taking out beforehand studies concerning geotechnical and land surveys, environmental impact assessment study and other necessary studies. The outcome of these studies should draft versions of bill of quantities, building plans and total project cost. Based

on the results, the steering group of all stakeholders will discuss about it and launch necessary measures to rectify obstacles such as land compensation and relocating processes. This phase will not be short due to town planning exercises, community hearings and bureaucracy with local communities, regional councils and even the ministries due the nature of this project.

However, in case mutual understanding and funding can be found, the engineer will finalize the project documents and starts a tendering process for contractors. Once the contractor has been awarded with the project, actual construction project will begin. A competent project manager will be appointed by the steering to represent town councils towards the contractor and the engineer. Once the project is finished and handover has been done to the steering group, operational use may begin.

6.1.3 Management and Operation of the Landfill Site

As indicated in Chapter 6.1.1, the three northern towns have to establish a steering group to manage the landfill site. This independent body should consist of town council employees, not only decision makers, due professionalism on waste management what the employees provide. Furthermore, there is need of professionals to take care of the operational management such as bookkeeping etc.

In future, there is a place for public-private partnership where all operational management is outsourced to a private company that takes care of the whole landfill site. They will provide the necessary work power, equipment, machinery and expertise to the operational activities. The company answers and reports directly to the steering group as well as pay surcharges to the cooperating town councils. The local authorities, such as Regional Electricity Distributors, will own it totally or partly or the company will be totally privatized.

6.1.4 Cost Estimation

The size of the landfill site is determined based on the population of the towns as the waste production depends on the population size. In fact, the landfill site should be based on the volume of the waste currently being dumped into all three dumpsites in Ondangwa, Ongwediva and Oshakati. Unfortunately, there is currently no exact data for the waste being dumped into the dumpsites. The size is also estimated by comparing the data of the three northern towns with Windhoek municipality data. The data from the Windhoek municipality and the three northern towns are comparable because all of the above mentioned towns are in the similar climatic conditions, have similar industries and similar culture, so the amount of waste produced per capita and the types of wastes should be comparable to each other.

Moreover, Windhoek landfill site has constructed two new landfill cells in addition to the four old already existing cells. One of the two newly built cells is for general waste, whereas the other one is for hazardous waste. Both of these cells were constructed recently in 2014. (Hewicke. 2014) Cost estimation of the landfill construction for the three northern towns is estimated by comparing the price with the price of new cells construction in Windhoek municipality. Table 6.1 shows the cost estimation of all key factors required to build a proper landfill site for all three towns. A private consulting company was used to formulate the costs.

TABLE 6.1. Cost estimation of one common landfill site

Description	**Amount in N$**
SCHEDULE A	
Construction of one cell for general waste (similar to Windhoek)	12 000 000
Construction of one cell for hazardous waste (similar to Windhoek)	18 000 000
Digital weighing bridge	650 000
Road, 1 km (tarred for heavy traffic, few culvert included)	8 000 000
Electricity supply, 1 km	500 000
Water supply, 1 km, 160 mm pipe	427 000
Office building, 108 m^2 (includes furniture and basic equipment)	737 000
Garage / Workshop, 600 m^2	4 095 000
Fence, 10 ha, 1,3 km	910 000
Land compensation, 10 ha	1 000 000
Wastewater pond, 2113 m^2, 1,7 m height embankment, (concrete and plastic lining)	2 500 000
SUB-TOTAL A	**48 819 000**
Contingencies 10%	4 881 900
SUB-TOTAL	**53 700 900**
VAT 15%	8 055 135
TOTAL ESTIMATED CONSTRUCTION COST	**61 756 035**
SCHEDULE B	
Professional fees	
Primary fees	471 785
Secondary fees 4.5%	2 416 540
Disbursements	
Topographic survey	200 000
Environmental Impact Assessment Study	400 000
SUBTOTAL B: Professional fees	**4 011 574**
VAT (15 % of the subtotal B)	523 248
Estimated Professional cost	4 011 574
TOTAL COST OF THE WHOLE PROJECT	**65 767 609**

It is worth noticing here that the price calculated for the common landfill site is based on the hypothesis that the new landfill site will be built in location that has not any infrastructure available. In case that the location is in area with existing infrastructure and services, such as roads, water and electricity, the cost of the new landfill will be 10-12 million less than the above estimated cost.

6.1.5 Cost and Revenue Distribution Among the Town Councils

The cost of constructing and operating the landfill site should be distributed among the town councils. One way of doing it could be the basis of population distribution in the towns. For example, the generalized ratio between Ondangwa, Ongwediva and Oshakati's population is almost 1:1:2 (28,7%: 25,4%: 45,9%) respectively. As the amount of waste generally depends on the population and industry, so the sharing of the expenses in that ratio can be reasonable. The alternative way could be to divide the cost and revenue based on the amount of waste produced from each town.

The landfill site will also generate revenue in term of the fee collection from the dumping at the landfill site, compost production and methane production. For example Windhoek landfill has collected N$ 11,05 million during last year (July 2013 - June 2014) from gate fees. Based on the population data and waste produced per head, the three towns should also generate around 2-3 million Namibian dollars per year from gate fees. In addition, the northern towns should also generate some revenue from compost selling and from methane gas selling. Part of total revenue will go to the operating cost and future extensions, whereas the net gain can still be divided among the municipalities in the same ratio as in the cost i.e. 1:1:2 for Ondangwa, Ongwediva and Oshakati respectively. It is highly recommended to allocate a certain percentage of the revenue for future development of waste management.

Regarding the gate fees, they should be adjusted in accordance with transport distances. For example, if the landfill is in Ongwediva, then the dumping fee for Oshakati should be less as compared to Ongwediva and the dumping fee for the Ondangwa should be less than both Oshakati and Ongwediva. This is because of the general transportation cost, such as fuel and time consumption.

If the common landfill plan is agreed according to scale 1:1:2, Ondangwa and Ongwediva should each contribute N$ 16,44 millions and Oshakati should contribute N$ 33,88 millions for the building process. The estimated total cost for the common landfill site is N$ 65,77 millions.

6.1.6 Advantages and Disadvantages of the Common Landfill Site

Advantages

The advantages of having a common landfill are as follows:

1. Cost of construction and operation of one common landfill will be less as compared to two separate landfills in the three northern towns.
2. The three northern towns have the benefit of sharing the cost of construction and operation.
3. Fewer officials will be needed to supervise the facility.
4. It will be easier to collect the methane for one landfill as compared to the two separate smaller landfills.
5. One location for the landfill will have less environmental impact as compared to the two separate landfills.
6. As Ondangwa and Oshakati have need to replace the current dumpsites it will be easier for these towns to agree on one common landfill site.
7. There will be less costly to develop the supplementary-shared infrastructure for one common landfill instead of two different landfills.
8. It will be easier for the private contractors to manage one common landfill instead of managing multiple sites.
9. One landfill means less probability of environmental accidents as compared to more landfills.

Disadvantages

The three northern towns may have problems in terms of dividing the cost and revenue.

1. There could be authority and right to decide issues among the town councils. For example right to choose between two private contractors who will manage the landfill site.
2. Difference of opinion on issues can also cause problems.

3. If in future, towns will decide not to cooperate with each other then it can be issue to decide who will own the existing landfill.
4. Old dumpsite's removal will be a problem in case of changing to one new common landfill site.
5. One common landfill could be near to one town and far from others; in this case it will cause more fuel to bring the waste to one common landfill.

6.2 Two Landfill Sites For the Three Northern Towns

Alternative option is to build two landfill sites for the three northern towns. Oshakati and Ongwediva are close to each other, so one of their already existing dumpsites can be upgraded into one proper landfill site, whereas Ondangwa's dumpsite can also be developed into a landfill site.

6.2.1 Cost Estimation

In case of two landfill sites, there should be no need to buy new land, as the dumpsite lands are already a property of the town councils. Ongwediva and Oshakati have currently approximately 62 000 people (The Namibia Statistics Agency. 2012) thus it will be wise for them to build one cell for general waste and one cell for hazardous waste. Ondangwa's population is third of that but nevertheless there is a need for similar structure and landfill site. Ondangwa's case the cell size should be smaller or other towns should be attracted to join the cooperation. Other infrastructure and cost should be the same as in the one common landfill site plan with exception of land compensations, roads and services. In reality some roads and services have to be built but due to lack of cost calculation expertise, they are left out. Cost estimation for Ongwediva and Oshakati landfill site cells' area is considered to be 2/3 of the size than in Windhoek and Ondangwa landfill cells' area is 1/3. Both estimations are presented in Table 6.2 and Table 6.3.

TABLE 6.2. Estimated price for Ongwediva and Oshakati landfill site

Description	**Amount in N$**
SCHEDULE A	
Construction of one cell for general waste (2/3 of size in Windhoek)	8 000 000
Construction of one cell for hazardous waste (2/3 of size in Windhoek)	12 000 000
Digital weighing bridge	650 000
Office building, 108 m^2 (includes furniture and basic equipment)	737 000
Garage / Workshop, 600 m^2	4 095 000
Fence, 5 ha, 5 km	455 000
Wastewater pond, 2113 m^2, 1,7 m height embankment (concrete and plastic lining)	2 500 000
SUB-TOTAL A	**29 437 000**
Contingencies 10%	2 943 700
SUB-TOTAL	**32 380 700**
VAT 15%	4 857 105
TOTAL ESTIMATED CONSTRUCTION COST	**37 237 805**
SCHEDULE B	
Professional fees	
Primary fees	471 785
Secondary fees 4.5%	1 457 131
Disbursements	
Topographic survey	200 000
Environmental Impact Assessment Study	400 000
SUBTOTAL B: Professional fees	**2 528 916**
VAT (15 % of the subtotal B)	379 337
Estimated Professional cost	2 908 253
TOTAL COST OF THE WHOLE PROJECT	**40 146 058**

TABLE 6.3. Estimated price for Ondangwa landfill site

Description	**Amount in N$**
SCHEDULE A	
Construction of one cell for general waste (1/3 of size in Windhoek)	4 000 000
Construction of one cell for hazardous waste (1/3 of size in Windhoek)	6 000 000
Digital weighing bridge	650 000
Office building, 108 m^2 (includes furniture and basic equipment)	737 000
Garage / Workshop, 600 m^2	4 095 000
Fence, 5 ha, 5 km	455 000
Wastewater pond, 2113 m^2, 1,7 m height embankment (concrete and plastic lining)	2 500 000
SUB-TOTAL A	**19 437 000**
Contingencies 10%	1 943 700
SUB-TOTAL	**21 380 700**
VAT 15%	3 207 105
TOTAL ESTIMATED CONSTRUCTION COST	**24 587 805**
SCHEDULE B	
Professional fees	
Primary fees	471 785
Secondary fees 4.5%	962 131
Disbursements	
Topographic survey	200 000
Environmental Impact Assessment Study	400 000
SUBTOTAL B: Professional fees	**2 339 003**
VAT (15 % of the subtotal B)	305 087
Estimated Professional cost	2 339 003
TOTAL COST OF THE WHOLE PROJECT	**26 926 808**

6.2.2 Advantages and Disadvantages of Two Landfill Sites

Advantages

The benefits of building two landfills can be as follows:

1. Administration of the landfill will be easier as compared to one common landfill because Ondangwa will be solely responsible for its own landfill construction and management. Ongwediva and Oshakati can share the cost and revenue among each other with 1:2 ratios respectively.
2. It will be easier for the towns to transport waste to the landfill site, as the distance to the landfill site will be shorter for all three towns as compared to the common landfill site.
3. Difference of opinion will be less probable, as Oshakati and Ongwediva will be only partners with each other in their common landfill site.
4. In case of any operation breakdown in one landfill site, the other site can be temporarily used for that time period.

Disadvantages

There are many disadvantages of having two landfill sites as compared to one common landfill site, such as:

1. The cost of building, two landfill sites will be much higher than building a common landfill site.
2. It will also be very difficult to bear the cost of separate landfill sites by each town because the budgets for waste management in the three northern towns are generally not very high.
3. More expertise will be required to ensure proper construction and operation of the two-landfill sites as compared to one.
4. Two separate private contractors will be needed for the landfill construction and landfill management, which can result in almost double the operational cost of one common landfill site.
5. The probability of having an environmental mishap will be double as compared to one common landfill site.
6. Technically, it might not be possible for two landfill sites to produce methane separately because of the waste volume deficiency; this can result in less revenue generation from waste management.

7. Payback time for the two-landfill sites will be longer as compared to one common landfill site.

6.3 Recommendations for Building and Operating the Landfill Site

1. The data used in the sizing and cost estimation of the landfill site is not very accurate in terms of population, volumes of the waste produced per capita and the price of the construction and materials. Therefore it is strongly recommended to have a thorough survey and design before constructing the actual landfill site.
2. A geological survey and EIA should be done beforehand.
3. No development should be allowed in the radius of one kilometre around the landfill, so that the landfill can be extended in the future if needed.
4. If one landfill is agreed between three municipalities, a written document with very clear and understandable terms and conditions should be agreed between all stakeholders before the work starts.
5. In case of a common landfill site, there should be a free independent body with representation from all three towns that are capable to operate and supervise the landfill's technical, economic and operational issues.
6. In case of a common landfill, there should be a private contractor who will control the landfill site and will collect and record the revenue from the waste disposal. Contractor should report to the common independent body of the three northern towns.
7. This independent body should be responsible to distribute the cost and revenue among the municipalities.
8. If the two landfills plan is agreed, it will be desirable to develop Ongwediva's dumpsite into a landfill site.

6.4 Possible Investment Resources

In Namibia, waste management does belong directly under any ministry but there are several ministries as stakeholders. During the study several stakeholders were identified who could provide funding for actualizing the recommendations of this study.

6.4.1 Local Authorities

The three northern towns are the main beneficiaries of the possible common landfill site(s). Developing an agreement of how each town can contribute, will be the starting point of this project, were each town council will raise fund on its own. For example raising money from the community, cutting some the expenses in the various departments or finding other ways to raise funds. This will give a chance to these towns to work together through a development plan.

6.4.2 Governmental Bodies

Ministries

In Namibia each town or village is responsible for its own waste management. Although local authorities are managing both sewage and waste management, they are still under supervision of the Ministry of Environment and Tourism (MET) and Ministry of Regional and Local Government, Housing and Rural Development (MRLGHRD). Through this structure the ministries implement legislation to guide the local authorities on how to manage their waste in their respective towns. Furthermore, one of the objectives of the MET is to promote and establish suitable solutions to waste management. This Ministry has a program of Environmental Management and Regulation. The main purpose of this program is to ensure sustainable development by avoiding environmental degradation and non-sustainable use of our resources in the country. In this program the main activities are environmental assessments, pollution control and waste management. Through the cooperation of these two ministries' considerable funds can be raised. This will create a platform for both ministries to work together and ensure that some of their goals are achieved.

Environmental Investment Fund of Namibia

The Environmental Investment Fund Namibia (EIF) can be a very potential source for funding this project. The aim of EIF is to release funds for the activities, which are environmental friendly. EIF gives grants and loans to potential and deserved projects. An application can be sent to EIF, a board of directors and experts review the application and select the suitable applications for grant. This institution can give a grant up to N$

350 000 or even more if the project warrants it. EIF can also issue some green loans in addition if required. (Environmental Investment Fund of Namibia. 2014)

Development Bank of Namibia

Development Bank of Namibia (DBN) is a government-owned development bank that helps to finance or invest capital in local projects, private enterprises and small or medium enterprises. The bank helps local people to borrow money to establish their business or projects. So far this bank has managed to help many upcoming entrepreneurs in Namibia with funds to start their businesses. DBN believes that supporting innovative ideas that are financially and economically beneficial to the country will help to stimulate development and help to sustain the bank. In 2006, this bank has assisted for example Enviro-fill Namibia. Enviro-fill Namibia is a local company that was awarded a tender for waste management at Kupferberg dumpsite in outside Windhoek. Enviro-fill later started to offer cleaning services in towns such as Swakopmund and Tsumeb. DBN helped this company to acquire some of the machinery such as a truck for the transportation of waste, a skip transporter and a tire cutter. (Development Bank of Namibia. 2014)

6.4.3 Foreign Investors

Partnership for Local Democracy Development and Social Innovation

Through the Partnership for Local Democracy, Development and Social Innovation (PLDDSI) between Finnish and Namibian municipalities, PLDDSI has supported many environmental and waste management studies in Namibia. PLDDSI can also support to raise fund or expertise for the completion of waste management projects in general.

United Nations Environmental Programs

United Nations Environmental Program (UNEP) focuses on various ways how to safely and effectively handle solid waste. The centre aims to promote awareness, implement various ways on how to handle waste, create safe environments when dealing with waste. The centre also tries to find different ways on how to reduce waste, through the policy of reuse and recycling some of the waste such as e-waste, bio-waste and plastics. Including such an organization in this project will be beneficial. This will bring various

nations together and create investment opportunities in the three towns. (United Nations Environment Programme. 2014)

GIZ Organisation (Deutsche Gesellschaft für Internationale Zusammenarbeit)

GIZ is an organization that has been in Namibia since it's independence, on behalf of the German Federal Ministry for Cooperation and Development. These organizations have been operating in Namibia for many years. Namibia is a developing country that is faced with many challenges such as unequal distribution of resources, poverty, and lower level of education, unemployment and economic development. For this reason this organization has been implementing many different projects to help solve or reduce such challenges. In 1999, this same organization has sponsored a study on waste management, were it was suggested that a landfill must be built in Ongwediva. Through this project the organization also managed to provide Ongwediva Town Council various waste collection equipment, which are still in use today. Although this construction of the landfill site as suggested never materialized due to the lack of other sponsors at the time, the sourcing of funds via this organization is still an opportunity. (GIZ Organisation. 2014)

6.4.4 Private Investors

Köningstein Capital

Köningstein Capital is an independent corporate financial service in Namibia. With its main office in Windhoek, this corporation has established a support network though funding and investing into various projects around the country. Last year this corporation has invested in two housing and residential projects, Okahandja Housing Development and Hosea Kutako Apartments in Windhoek. This corporation objective is to target projects that are encouraging development in emerging towns. (Windhoek Observer. 2013; Köningstein Capital. 2014)

Safland Property Group Namibia

Safland is a property group, which focuses on areas such as project development, research studies and creating investment opportunities in small towns. With the aim to help Namibia to reach its millennium goals, SAFLand has helped several towns around

Namibia to have modern and attractive shopping centres. Recently this group had invested in three projects Grove Mall in Windhoek, Town Square in Otjiwarongo and Gwashamba Mall in Ondangwa. These projects had created investment opportunities in the three towns. Inviting such a company to take part in this project will be beneficial since its main mission is to invest in into entrepreneurial projects. (Safland Property Group. 2014)

7 MASTER PLAN FOR WASTE MANAGEMENT

The aim of the master plan for waste management in the three northern towns is to build a waste management system, which is economically self-sustainable, environmentally friendly, easy to operate, easy to use for people and effective in creating a change in the northern towns. The underlying principal of this plan is to reduce, reuse and recycle (RRR).

7.1 Reduction of Waste

Steps should be taken to reduce both industrial and domestic waste. Regulations should be made to enforce waste management systems in the communities and also to the industries. All waste producing industries should be taxed based on the quantity and type of the waste that they produce, and the towns should take the responsibility for the proper recycling and removal of the waste, either themselves or by means of private contractors. Individual houses are already being charged for their waste disposal and more efforts should be made, so that communities become part of the waste management system.

This new waste management culture will not emerge from nothing; people's behavior can only be changed by education and information. There have been several cleaning campaigns in all three towns, which is very good thing, but cleaning is just one part of the waste management system. There is a strong need to educate the people about harms related to wastes. People should be informed and instructed to reduce the waste as much as they can. Different ways to reduce the waste production should be promoted, advertised and applied.

The reuse of material should be encouraged and the aim of the campaigns should be to raise understanding of the problem, and increase the sense of responsibility in people towards waste management. People should know that the waste is not only town councils' and government's problem but instead, it is affecting everybody's life thus it should be everybody's responsibility. Schools, colleges, churches, notice boards, and all

type of media should be used to raise the awareness in the public about waste management.

The community and businesses should adapt more environmentally friendly ways to reduce waste. For example, shopping markets should provide reusable fabric or plastic bags instead of providing lot of polythene bags, which cannot be reused and will simply go to waste containers or wilderness. It is good idea to put some price on polythene bags instead of giving it for free. It should be banned to provide free plastic bags with shopping. Putting even a minor price on polythene bags will surely significantly decrease the amount of polythene bags in the waste.

Soda stream machines should be encouraged for soft drinks and for alcoholic drinks instead of glass, PET and tin bottles. If possible there should be some return money on PET, tins and glass bottles so that the user can bring it back to the shop instead of throwing it on the streets.

7.2 Waste Collection

One of the reasons of waste pollution in the three northern towns is the absence of proper waste collection points and infrastructure. The municipalities should provide proper waste containers to both community and also to the businesses. There should be at least 3-4 different types of containers for collecting different types of wastes such as paper, plastic, metal and general waste. It's highly recommended to use deep collection systems such as Moloks. As a minimum, one set of waste containers should be installed at least at the beginning and end of each street. If it is currently too costly to provide deep waste collection system, then at least 3-4 plastic or metal containers with lids should be provided. In the future, however, deep collection units should replace these one by one. Waste collection infrastructure should be taken into consideration when planning and designing new town layouts. Low-income earners in informal settlement should be provided with the required information and free waste collection units.

7.3 Administrative Check and Balance

At the moment, waste management is under sub-departments of Environment and Public Health Departments. Duties and tasks are not clearly defined on the administration level. Waste management should be separate departments instead of being part of Environmental Management and Public Health Departments as a whole. There should be competent and qualified staff that should be assigned with clearly defined duties and responsibilities. A proper checking system should be developed within the municipality and everybody should be held accountable for their duties and responsibilities.

7.4 Control of Illegal Dumping and Trash Throwing

Patrol Control Units should be established in all towns to control illegal dumping and garbage throwing. The Patrol Control Unit with the help of the local police should be provided with cars and the authority to impose spot fines. Teams should drive around the town 24/7 and observe the illegal dumpers and trash-throwers. An exercise like that can be very useful to eradicate the roadside trash and illegal dumping. By-laws should be developed by the town councils to deal with the large occurrence of illegal dumping and also for the people who fail or resist paying on-spot fines for garbage throwing.

7.5 Waste Transport

The waste transport systems are already working satisfactorily in all three northern towns, but still there is a lot of room for improvement. At the moment all type of waste is being mixed during the collection. After the installation of separate waste collecting units, all different types of waste should be collected separately. One collecting truck should be allowed to collect only one type of waste during the trip or it should have separate compartments for the collection of different waste categories. For example a truck which already has paper collected from some spot should not be allowed to collect kitchen/bio waste at the same time in the same truck. Different types of the waste should be transported directly to their destinations so that there is no need for the material sorting, recovery and re-cycling facility. Different recyclable like, plastic and glass should be collected separately so that it easy to sort them out in different types after-

ward. Under no circumstances, recyclables, non-recyclables and hazardous waste should not be mixed.

Only those private contractors who have proper resources for waste collection should be appointed. For example, private contractors who have open trucks should not be allowed to collect waste as they carry the danger of spreading the trash on road. Private contractors should be required to develop their machinery for proper collection of the deep collecting units in the near future. Record keeping and reporting should be strictly imposed on all the waste collectors and transporters.

Towns should provide several, for example around 10 or more, special dedicated collection points for batteries, electronics, and hazardous waste in each town, so that these types of waste will not mix with the general waste. A private contractor should be appointed for the proper management of such electronic and hazardous waste. Hospitals should have working incinerators and all pathogenic and chemical waste from hospitals should be treated before transporting to the landfill sites.

7.6 Waste Disposal

All the refuses should be transported to the proper landfill site. A proper landfill represents a place, which is designed to dispose different types of the waste in the way that they will not cause any harm to the environment. The landfill should be cost-effective and economically self-sustained. Everybody bringing the refuses to the landfill site should be charged based on the type and amount of the waste. The landfill should have at least two different cells, one for the general waste and another one for the hazardous wastes. A landfill should also include the methane collection unit and a composter unit, so the bio-waste could be transformed effectively into useful products like burning gas and manure for agriculture. Two separate plans for building landfill are discussed in Chapter 6. One of these plans should be followed for proper waste disposal.

7.7 Economy of Waste Management

Waste management should be a self-sustained economical process. The waste management process should generate its own revenue. In-fact each component of the waste management cycle should be economically self-sustained. For example the expenses of waste reduction campaigns and advertisement should be covered from the tax-imposed on waste production in industries.

Similarly, waste collection and transportation is also an economically sustainable process. Houses and businesses are already being charged for waste collection. This money should be sufficient to pay the private contractors for waste collection and transportation. A part of this money should be spent every month to buy more waste containers for the community or to support local companies for building more and more deep waste collection units in the communities. It is obvious that when the fee will be imposed for taking wastes to the landfills, some people will try to avoid charges by illegal dumping. To control the illegal dumping a Patrol Control Unit is strongly advised. This unit should also be self-sustained in term of economics and as they will have the right to make spot fines, this money should be enough for covering the expenses of the patrolling unit and also for the management staff.

In the end at the waste disposal cycle at the landfill, everybody should pay the gate fee depending on the nature and amount of the waste. The revenue collected from the landfill usage should be sufficient to run the landfill and also for the future development of landfill sites and waste management system as a whole. The flow chart in Figure 7.1 explains the self-sustained economy of whole waste management system.

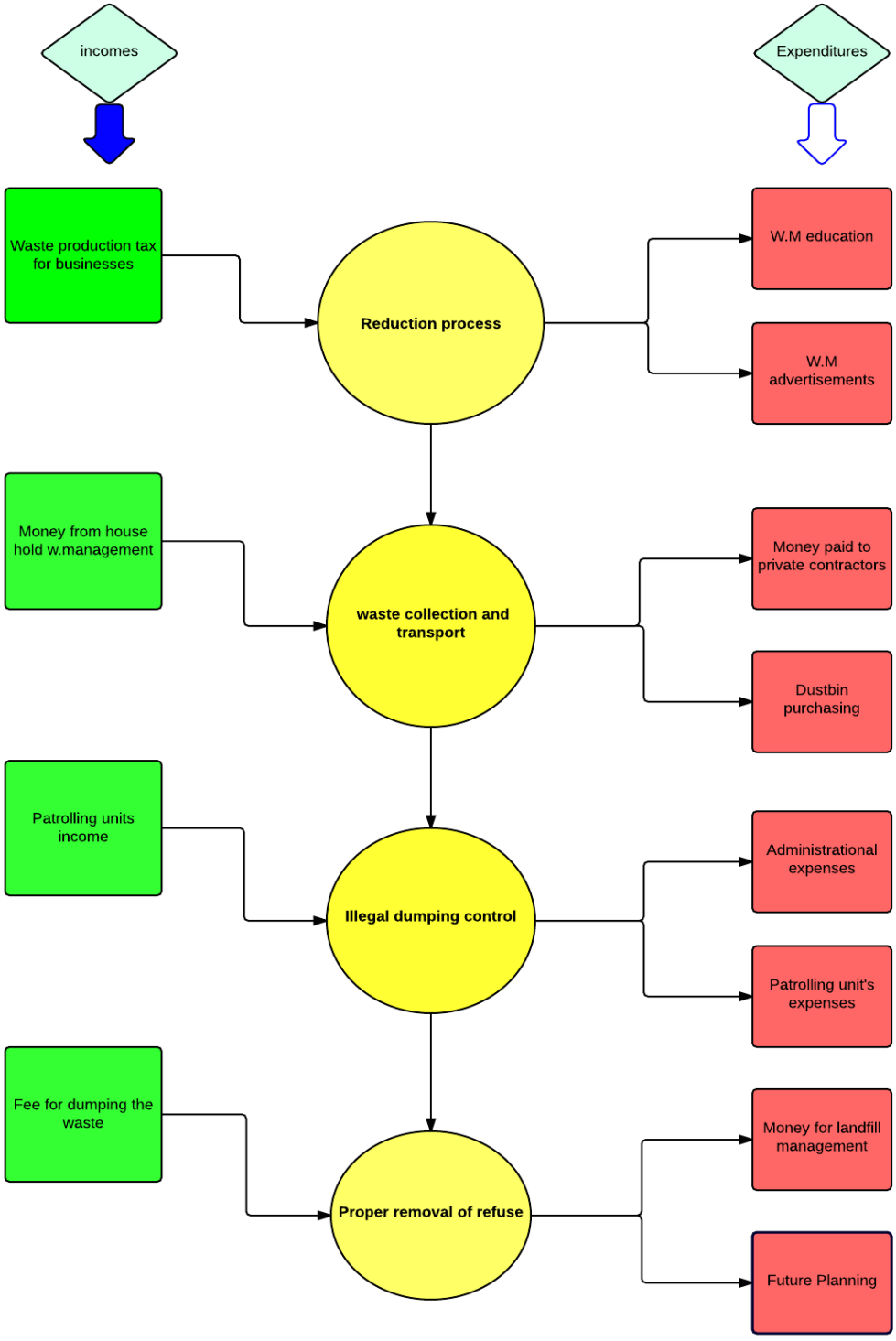

FIGURE 7.1. Economy of waste management operation system (Mughal, 2014)

8 DISCUSSIONS

8.1 Challenges faced during the work

The study was conducted in really short time, in about a month. Despite the shortage of time most of the study targets are successfully achieved. One required field of the study was to identify at least one type of recyclable that could be recycled within the Namibia. As at the moment all recyclables are sent out of the country for recycling. Due to the shortage of time, unfortunately that part of the study has not been covered.

The cost estimation for building one common landfill site should be somewhat accurate due to help of a local engineering consultant and relevant figures obtained from Windhoek municipality. What comes to building two separate landfill sites, the accuracy may be seriously compromised. This is because of too ruff estimations of the cell sizes and lack of cost calculating skills of buildings, services and roads. In general, it is clear that an upgrade from dumpsite to landfill site is project what starts from scratch. The existing dumpsite infrastructure does not provide any advanced starting position meaning there might be even extra costs to modify the land suitable for construction process of the landfill site. Furthermore, none of the management, except project management, costs before and after the building process has not been considered.

The availability of the data has been an issue during the study. Some of the data was generated during the study by conducting interviews, surveys and observation. In the data production process the shortage of time also produced some problems. It would have been desirable to conduct a survey with more questions and among more people, especially in the villages and remote areas. In this case the survey was conducted only in the towns and open markets, so it was difficult to ensure that people from all backgrounds have participated in the survey. The fact that students were responsible to conduct this study has also affected the study. Some town officials were reluctant to cooperate fully with the students and not all the requested data was provided.

8.2 Findings and recommendations

Namibia is a developing country and like other developing countries of the world, they also have financial problems. Funds are scarce. Although some of the Northern municipalities have not fully consumed their annual waste management budget, but still even if they would fully consume all their available resources they will not be able to overcome the waste management problem in the area. There is strong need of financial aid from any external source (Foreign countries, NGO'S, private sector or some international Environmental Protection agencies) to solve this problem.

Working environment is usually old cultured and duties are not well assigned. An example of old culture working habit is "competition". Although in many cases it's a good thing to have a healthy competition for improvement in the performance but the environmental issues are usually of such a large scale that they need to tackle collectively instead of individual efforts. Therefore it is strongly recommended that Northern municipalities should prefer the principal of "cooperation over competition" to solve their waste management problem along with other environmental challenges. Some other issues like lack of effective planning and proper management are also need to be handled. Professionalism develops with time and experience; therefore international cooperation, positive intent of Namibian people and increase in literacy rate will finally replace the old-culture-working environment with new professional management.

Namibia is a recently established state, so its laws and regulations are not yet fully established especially in case of waste management. An over view of Namibian Environmental and waste management act show that although guidelines are there for the waste management issues but still there are a lot of grey areas in the regulation which are not fully described. There is a strong need to develop the legislation into more detailed. Then the laws and regulation of the waste management should be implemented. Awareness should be spread in general public regarding their right and responsibilities towards waste management. Changes does not happen over night and especially environmental issues such as waste management are strongly related to the change in cultural norms and values, therefore its is recommended to start massive information campaign in all sectors of life. Old people, teenagers, working class, women and especially the children every body needs to be educated so that a good waste management culture could be established. On the other hand municipalities need to build cooperation with local peo-

ple for the solution of waste management problem. Local inhabitants should be taken into account during the planning of new waste management system and public participation should be taken into account. A double-way communication and feedback system should be developed between municipalities' officials and local inhabitant and people should be encouraged to give feedback, creative ideas and positive criticism.

Waste should not be treated as waste. Many developed countries like Sweden, Germany and Finland etc. has modified the waste management into a profitable industry. They are creating both energy and considerable amount of profits from waste management industry. Northern municipalities are required to follow the same example. On the other hand Government alone cannot properly handle all the issues alone, therefore there is a need to develop roam for the private sector in waste management in Namibia. In fact Namibia has already done some privatization of waste management sector in some bigger cities like Windhoek and few private companies are working even in Northern Municipalities also but private sector needs to be encouraged more. With the growing private sector in the northern municipalities there is a need to develop better guidelines and regulation for contractors and subcontractors in the waste management sector. Northern municipalities have developed basic contract system with the private contractors, duties and requirements are well defined but the feedback and surveillance system is still at its initial stage and it needs some changes to make it more effective.

9 REFERENCES

Alsins A., Sundgren A., Shooya R.N.M. & Nashongo T.N. 2013. Analysis of qualities and quantities of waste and recyclables in the Namibia Towns. Polytechnic of Namibia, Tampere University of Applied Sciences, Rent-a-Drum cc & Molok Oy.

Around the World 360. 2014. Accessed on 1st of September 2014. Available at http://www.aroundtheworld360.com/

City of Windhoek, Solid Waste Management Division. 2014. Waste quantities. Accessed on 9th of September 2014. Available at http://solidwastemanagement.org.na/landfill-satellite-sites/kupferberg-general-and-hazardous-landfill-site

Development Bank of Namibia. 2014. Accessed on 8th of September 2014. Available at http://www.dbn.com.na/

Environmental Investment Fund of Namibia. 2014. Accessed on 15th of September 2014. Available at http://www.eifnamibia.com/

GIZ Organisation (Deutsche Gesellschaft für Internationale Zusammenarbeit). 2014. Accessed on 8th of September 2014. Available at http://www.giz.de/

Google. 2014. Google Earth Imaginary.

Government of Namibia. 2014. Accessed on 18th of September 2014. Available at http://www.gov.na/about-namibia

Jones & Wagener. 1999. Waste Management Strategy for the Namibian Town of Ongwediva. Ministry of Regional and Local Government and Housing, Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) GmbH.

Köningstein Capital. 2014. Accessed on 18th of September 2014. Available at http://www.koenigstein-capital.com/

Mazibuko D., Jansen C. & Zeriapi I. 2013. Occupational Health and Safety Portfolio at Rent-a-Drum Waste Recycling Company. Polytechnic of Namibia.

Ministry of Regional and Local Government, Housing and Rural Development. 2014. Accessed on 4th of September 2014. Available at http://www.mrlgh.gov.na/

Ministry of Environment and Tourism. 2014. Accessed on 4th of September 2014. Available at http://www.met.gov.na/

Ondangwa Town Council. 2013. Sample of a Waste Collection and Removal Contract with Private Contractor, No TC/2013(23/12/2013). Ondangwa Town Council.

Palander, M.-M. 2013. Average weight of waste in Molok Deep Collection system in Namibia. Tampere University of Applied Sciences.

PLDDSI - Partnership for Local Democracy, Development and Social Innovation. 2014. Accessed on 1st of September 2014. Available at http://www.lempo.fi/namibia

Safland Property Group. 2014. Accessed 18th of September 2014. Available at http://www.safland.com/

Sundgren A. & Alsins A. 2013. Monitoring of Moloks in Coastal and Northern Namibia. Tampere University of Applied Sciences.

Stubenrauch Planning Consultants. 2012. Ondangwa Structure Plan 2012-2042 Final Report.

Government Gazette of the Republic of Namibia. Environmental Management Act 7 of 2007. Ministry of Environment & Tourism, Namibia.

The Namibia Statistics Agency (NSA). 2012. Namibia 2011 Population and Housing Census Main Report. Accessed on 17st of September 2014. Available at http://www.nsa.org.na/

United Nations Environment Programme. 2014. Accessed on 18st of September 2014. Available at http://www.unep.org/

Windhoek Observer. 2013. GIPF commits billions to unlisted investments. Accessed 1st of September 2014. Available at http://observer24.com.na/business/2043-gipf-commits-billions-to-unlisted-investments

Project related personal communication

Du Plessis, Arno. Lithon Project Consultants. 4th of August 2014.

Elago, Martin. Chief Executive Officer. Ondangwa Town Council. 9th of September 2014.

Erickson, Kambonde. Cleaning Officer. Oshakati Town Council. 12th and 29th of August 2014 & 8th of September 2014.

Hewicke, Andrea. Landfill Sites & Technical Support. City of Windhoek. 25th of August 2014.

Holtzhausen, Frikkie. Managing Director. Lithon Project Consultants. 4th of August 2014 & 10th of September 2014.

Kapolo, Cornelius. Senior Health Officer. Oshakati Town Council. 12th and 29th of August 2014 & 8th of September 2014.

Kashihakumwa, Penda. Environmental Health Manager. Ongwediva Town Council. 8th of August 2014 & 2nd of September 2014.

Loide, Shiimi. Cleaning Officer. Ondangwa Town Council. 14th, 15th and 21st of August 2014.

Mweva, Lameck. Dean of School of Natural Resources and Tourism. Polytechnic of Namibia. 4th of August 2014.

Ndjodhi, Paulus. Environment Health Manager. Ondangwa Town Council. 20th of August 2014.

Swanepoel, Johan. Regional Supervisor. Rent-a-Drum. 6th of August 2014.

10 APPENDICES

APPENDIX 1 Survey for the local people

Please choose the options appropriately and let us know about your precious improvement ideas (A bundle of thanks from your Municipality)

Q.1 How is the waste management in your area?

A) Good( ) B)very good( ) c) excellent ( )

a) Bad( ) B) very bad( ) c)catastrophic( )

Q.2 Do you have waste containers in your areas?

a) yes ( ) b) No( )

Q. 3 What types of waste containers do you have?

a) Plastics Bags( ) b) Plastic containers ( ) c) Other (specify) ……..

What do you suggest for improvement? ----------

Q.3 How often your waste-bin have overfilled?

……Days/month

Suggestions for improvement?

Q. 4 Do you separate different types of wastes while disposing? If yes how many types do you separate?

a)Yes I separate ( ) b) No I don't separate ( )

Q. 5 Have you ever been instructed about waste separation or waste management? If yes how many times?

A) Yes ( ) b) No( )

Q.6 did you have any waste management studies in your school?

A) Yes( ) b) No( )

Q. 5 have you ever visited the dumpsite?

A) Yes( ) B) No( )

Q.6 If you have visited the dumpsite what do you think about it?

A) Its ok( ) b)Its good( ) C) Its very good( )

d) Its bad( ) E) Its worse ( ) F) Its catastrophic( )

What do you suggest for dumpsite improvement?

Q. 7 who should be responsible for proper waste management?

A) Local people( ) B) municipality( ) C)both( ) D)None( )

Your ideas about the improvements?

APPENDIX 2 Questionnaire for environmental health officers

1. How is the solid waste management condition in your areas? Explain in few words?
2. Are the legal requirements being fulfilled in accordance with waste management?
3. Are you satisfied with the current rules and regulation regarding the waste management?
4. Are you spending your waste management budget completely on waste management?
5. How many people are working for town for waste collection? What types of personnel safety equipment is provided to them? What types of tools are being used and how much do you have of it?
6. How many studies have been conducted in your areas about the waste management in your areas? Do you have all the reports?
7. What types of wastes the town is collecting?
8. What suggestions do you have to improve the legal system of waste management?
9. Have you ever run a cleaning or waste management campaign in your areas?
10. How often people are being reminded about their responsibilities and rights towards waste management?
11. Is there some fee of solid waste management for the business and domestic waste producers? If yes how much is being charged?
12. How many private contractors do you have for waste collection, and recycling purposes?
13. What types of instructions have been passed to the private contractors?

14. Are private contractors paying to the town for waste collection or for using town dump sites?
15. How big is your dumpsite in term of area and waste holding capability?
16. How long the current dumpsite can sustain the waste?
17. Do you have an estimation that when will you need to build a new landfill site?
18. What do you think about the dumpsite condition in your areas?
19. Are you satisfied about the health protection of the workers working in the dumpsite?
20. How eager are you to build up a proper landfill site in your areas?
21. What are the issues? That the proper waste management hasn't been successful in your areas?
22. Will it be useful for the town to build its own recycling and sorting unit?
23. Do you have any ideas how to use/manufacture the recyclables in the three northern towns?
24. Can you describe the organization structure for waste management and who is responsible for what?
25. What type of logistic / machinery you have at the moment? Is it being used effective?